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5 Compositions and methods for the alteration of the disulfide status of plant proteins are provided. Novel nucleotide molecules, comprising nucleotide sequences for thioredoxin *h* and NADPH-thioredoxin reductase, and the proteins encoded thereby are provided. The nucleotide sequences can be used to transform plants alone or in combination with other sequences, such as sequences encoding NADPH generating  
10 enzymes, to manipulate the thioredoxin *h* system and alter the protein disulfide status in plants. Transformed plants, plant cells, plant tissues, seed and grain are provided.